Game Design Concept Report

Application of the WeShareIt Game Elements in Nzoia River Basin

Onencan, Abby; Enserink, Bert; van de Walle, Bartel

DOI
10.4233/uuid:3a1f1e27-274b-4459-8a14-ba3068a9cb4a

Publication date
2018

Document Version
Accepted author manuscript

Citation (APA)
Onencan, A., Enserink, B., & van de Walle, B. (2018). *Game Design Concept Report: Application of the WeShareIt Game Elements in Nzoia River Basin*. Delft University of Technology. https://doi.org/10.4233/uuid:3a1f1e27-274b-4459-8a14-ba3068a9cb4a

Important note
To cite this publication, please use the final published version (if applicable).
Please check the document version above.

A.M. Onencan, Author
B. Enserink, Co-Author
B. Van de Walle, Co-Author

Game Design Concept Report

Application of the WeShareIt Game Elements in Nzoia River Basin

Game Design Concept Report

Application of the WeShareIt Game Elements in Nzoia River Basin

By

A.M. Onencan Author

Ph.D. Researcher
at the Delft University of Technology,

Promoter:	Prof. Bartel Van de Walle,	TU Delft
Supervisors:	Bert Enserink,	TU Delft
	Rens Kortmann,	TU Delft
	James Chelang'a,	Moi University
Game Designers:	Abby Muricho Onencan,	TU Delft
	Simon Tiemersma,	GameLab, TU Delft
	Nathan van Ofwegen,	GameLab, TU Delft
	Caroline Nevejan,	Municipality of Amsterdam
Game Testers and Facilitators:	Abby Muricho Onencan,	TU Delft
	CE Delft Staff	CE Delft
	Wesley Chirchir,	MUCPR
	Felix Kulei,	MUCPR
	Peris Talam,	Moi University
	Amos Olweny,	Moi University
	Milka Etukuri,	Moi University
	Bernard Kipkoech Cheruiyot,	Moi University
	Wilfred Chacha Rotich,	Moi University

TU Delft

An electronic version of this game design concept report is available at http://repository.tudelft.nl/

To reference this document use: http://doi.org/10.4233/uuid:3a1f1e27-274b-4459-8a14-ba3068a9cb4a

Contents

1 The Introduction

1.1. Background of Nzoia WeShareIt Game

In early 2016, we designed Nzoia WeShareIt game to support joint decision-making, in a complex river basin, through policy practice in the form of water allocation trade-offs between food, energy, and nature. Nzoia WeShareIt game is a multi-player hybrid cooperation game [1]. Hybrid in this paper refers to a game that combines both the benefits of a board game and an online computer game to develop a mixed game. Mayer (2009) defines **games** as:

> "experimental, rule-based, interactive environments, where players learn by taking actions and by experiencing their effects through feedback-mechanisms that are deliberately built into and around the game [2 pp. 825]."

The Nzoia WeShareIt game is part of the WeShareIt doctorate research project of the Delft University of Technology, initiated with a scenario development process [3, 4]. Within this project, we developed four plausible scenarios of how the Nile Basin would look like in 2050, with the Nile Basin stakeholders in Jinja, Uganda in February 2014 [5]. We facilitated the scenario development process, with the financial support of BothENDS[1]. Afterward, we presented the scenarios to the eleven Nile Basin Ministers and over 400 stakeholders in Nairobi, Kenya on October 2014 [4, 5]. We made the presentation during the Bi-annual Inter-Governmental Nile Basin Development Forum (NBDF) [1, 3-5].

As a result of this presentation, the eleven Ministers of Water communicated that they would not want one of the scenarios (known as "Miskeen" which is an Arabic and Swahili (Maskini) word for "Poor") to be their future. In "Miskeen" scenario all the countries worked unilaterally and depleted all the Nile Basin water resources that by 2050, the river was completely dry and there were serious water scarcity issues across the basin [1, 3-5]. To address this challenge, the Ministers requested the scientists in the NBDF, including the Delft University of Technology to develop decision support innovations, aimed at helping them to resolve the complex Nile Basin issues and avoid the realization of the "Miskeen" scenario [6]. On October 2014, the Delft University of Technology started this journey through first developing a decision support game for the entire Nile basin [1, 7] and later customizing this game for the Nzoia Basin.

The original WeShareIt game, developed in 2014, focused on water allocation processes in the whole Nile Basin [1]. The Nile river is the longest rivers in the world with a basin area that covers one-tenth of Africa's total landmass [8]. The Delft University of Technology customized the Nile WeShareIt from an existing game known as BIOMAdneSS. BIOMAdneSS is a game designed by the Delft University of Technology for CE Delft[2] to increase peoples understanding of the struggle for biomass and the effects of such a struggle. CE Delft was instrumental in the initial design of the Nile WeShareIt, by providing the game specifications and technical input, during the design and testing of the game.

---

[1] BothENDS is a non-profit organisation based in Ansterdam, The Netherlands. Its "mission is to strengthen global civil society in order to gain decisive influence on the use of nature and the environment, thus contributing to societies that stay within our planetary boundaries and respect all human rights, including the rights to water, food and a safe living environment"(http://www.bothends.org/en/Themes/Mission-Strategy/)

[2] CE Delft is an independent research and consultancy organization that specializes in developing innovative solutions to environmental problems (https://www.ce.nl/).

After the application of the Nile WeShareIt game, in October 2015, the Kenyan Ministry of Water and Irrigation (MWI) recommended the redesign of the game for a smaller river basin within the Nile basin [1].[3] Through consultations with our partners, we identified Nzoia river basin as the select project area. Nzoia basin (34.4°, 35.6°E/ 0.1°,1.3°N) is part of the Lake Victoria Basin in Kenya [9]. Lake Victoria is one of the sub-basins of the Nile Basin [8]. Nzoia basin is approximately 12,000 square kilometers [9]. The basin comprises of six county governments: Trans Nzoia, Uasin Gishu, Kakamega, Bungoma, Busia, and Siaya.

Between October 2015 and July 2016, the Nzoia WeShareIt game was designed through an iterative process of designing, testing, applying and redesigning. The game client is the Nzoia River Basin policymakers. After designing the game, we tested it in Uasin Gishu county government [10]. The game was further refined based on the recommendations received during the game testing sessions in Uasin Gishu county. In July 2016, the game was ready to be applied in the Nzoia river basin. We immediately implemented seven-game sessions in four county governments. This report describes the game design concept and its application in Nzoia river basin, by referring to the seven-game sessions conducted on the 11th to the 22nd of July 2016.

The game has multiple benefits for various partners. For the Nile Basin policymakers, the game enabled them to jointly assess feasible water cooperation policy options that they intended to implement in future and assess their likely effects, in a safe environment. This information helped them in making informed decisions on what process is required to reach an **equitable benefit and cost-sharing framework**. For Moi University, a partner in the game formulation and implementation, the entire process was a learning and knowledge transfer opportunity because they had not used serious gaming, in their past interventions. Moi University Centre for Public Sector Reforms (MUCPR) was a critical partner in testing and improving the game due to their expertise in the public sector and policymaking in Kenya. We also designed the game for research purposes, that is to generate ideas on how to enhance water cooperation through the use of serious gaming. The Delft University of Technology intended to extensively collect data, with the aim of studying how gaming can be used to increase water cooperation in complex water systems [1, 4, 11].

1.2. Methodology for the Game Design Process

We developed this game design and application concept report through a piecemeal and iterative process, throughout the game development and application process. We wrote this concept report for three primary target audiences. The Nzoia WeShareIt developers, future game developers who are interested in developing similar games and as a reference point for the water resources management gaming and simulation scientific community. Many of our project scientific articles on the Nzoia WeShareIt game, briefly describe it, due to word count restrictions. The detailed game design concept report helps readers of the scientific articles, to have a reference point where they can get more detailed explanations.

At the initial stages of the game design, we had to decide which methodology to adopt. We had two options. First, we considered designing the game as a creative process, like most pieces of art. If we adopted this approach, then we would only focus on the output and not the process we used to arrive at the final game. On the other hand, we could adopt the “craftsmanship” methodology to game design. Craftsmanship entails using a systematic approach to develop the game and document the process and details about the final output

[3] The Nile WeShareIt was designed and tested from January to September 2014. It was later applied in Nairobi, Kenya with the Ministry of Water on the 22 of October 2015. They proposed that we redesign the game to be played at a lower level of governance with a smaller basin. After that meeting, Nzoia WeShareIt was coined and the redesign process initiated.

so that we ensure that the process is repeatable and transparent [12 pp. 3]. We based the "craftsmanship" methodology of game design on the works of Duke & Geurts (2004) and Peters and van de Westelaken (2014) [12, 13].

Having adopted the "craftsmanship" methodology, we ensured that our approach is flexible by creating space for "art" within the "craft [12 pp. 3]." We chose the "craftsmanship" methodology due to the following advantages:

- The use of a proven design methodology led to a systematic and better-structured design process. The detailed descriptions, images, and lists of game contents and rules helped the team to better design and organize the game logically and consistently. Outlining the game helped to break it down into different parts and phases, distinguish various game products and increase process transparency.
- The "craftsmanship" methodology requires the involvement of all the relevant actors in the design team. The diversity of the team increased collaboration and team interdependence leading to better communication within the team and external actors. The game design concept report helped to create a shared understanding of the game between the developers, testers, facilitators, and supervisors.
- This concept report was slowly developed and refined to ensure quality game design, through the systematic processing and recording of both the substance and process. The game description also aided the team to make the relevant connections, make adjustments and add or remove items. The systematic iterative process enabled the design team to quickly identify at an early stage, the areas that need to be adjusted or redesigned. The approach helped to save time and resources and ensure that the final product was of high quality.
- The adopted systematic, replicable and transparent approach increased the validity of the game. Game validity was essential because the game is a representation of the real-life policy situation in the Nzoia river basin.
- In the end, we used the game description as a checklist to assess whether what we designed met the list of requirements. The checklist enabled us to evaluate whether the final product met the expectations of different actor's.
- When the game was ready to be played, we transformed the game concept report into a facilitators guide and a game rulebook in preparation for the game sessions. These documents provided useful guidance to the facilitators who were not part of the design team. Through reading the report, they could understand the choices we made and why we made them. They could also understand the game design elements in more detail. Therefore, the facilitators understanding of the game increased, and they were better prepared to facilitate the sessions.

1.3. Game Concept Report Structure

This concept report is a detailed description of the Nzoia WeShareIt game elements and their application. The report comprises of four main parts: the introduction, the body which details the game elements, a section dealing with the publications, which is the main project outcome and the appendices. In this report, the game elements section consists of fifteen parts. The first part is the introduction, followed by a description of the fourteen game elements. Two critical components of the game elements section are the explanation of the game contents and the game cycles including the steps of play. The five steps of play are harvest, trade, payment of the penalty, invest and re-allocate.

The appendices comprise of three parts: an explanation of the transition from BIOMAdneSS to WeShareIt, a detailed description of the changes we made when transitioning to Nile and Nzoia WeShareIt and a picture collage. The picture collage consists of various pictures of the Nile WeShareIt session and the seven Nzoia WeShareIt game sessions. Finally, we provide a list of bibliography.

2 The Game Elements

2.1. Introduction: Description of the Nzoia WeShareIt Game Elements

The Nzoia WeShareIt game is made up of fourteen (14) primary elements, as explained in detail by Peters and van de Westelaken [12 (2014, pp. 27-33)]. These elements are:

1. The Objective of Nzoia WeShareIt Game
2. The Participants
3. The Scenario
4. Game Contents (physical and virtual game items)
5. The Objective in the Game
6. Cycles and Steps of Play (macro and micro cycle)
7. The Roles (played, simulated and pseudo)
8. The Unexpected Events (planned, random, ad-hoc)
9. Rules
10. Decisions
11. Indicators and Assessment Criteria
12. Data
13. Computer Equipment, Accessories and Paraphernalia
14. Rules for the Implementation of the Game

We applied Nzoia WeShareIt game in four county governments (Busia, Trans Nzoia, Kakamega, and Bungoma) (Fig. 1).

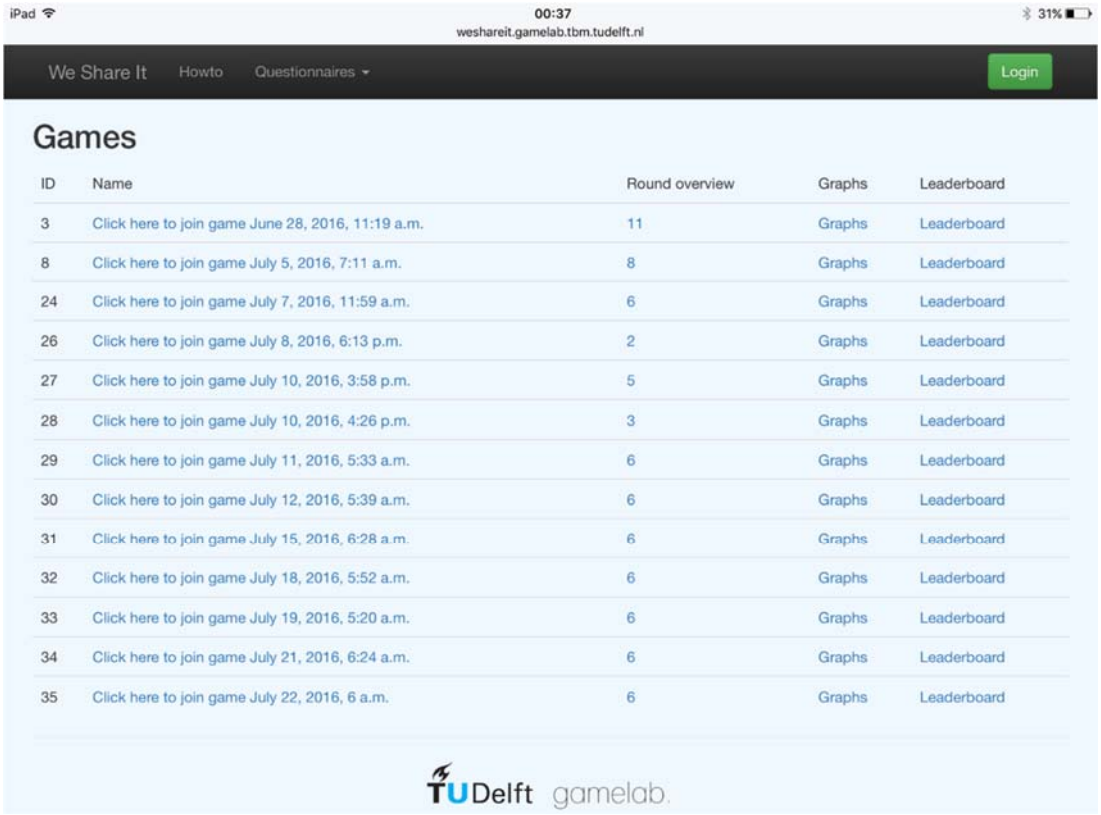

Fig. 1 Screenshot indicating the game testing and game application sessions and the number of rounds

The game was played by 35 policy makers, in seven-game sessions (See Figure 8). The first county government was Busia, where we held two sessions on the 11 and 12 July 2016. The second was Kakamega County Government, where 1 Session was held on the 15 July 2016. Kakamega policymakers were in Kisumu county government for an internal management meeting for the particular week, so we could only have one session. Third, we held two sessions in Bungoma County Government, on the 18 and 19 July 2016. Finally, we had two sessions in Trans Nzoia County Government, on the 21 and 22 July 2016.

This section will describe each of these fourteen game elements in detail while focusing on the Nzoia WeShareIt game design and application.

2.2. Nzoia WeShareIt Game Objectives

The primary objective of the game is to support joint decision-making, in a complex river basin, through policy practice in the form of water allocation trade-offs between food, energy, and nature. Different trade-offs have different effects, for instance, on the amount food and energy produced, the protection or non-protection of ecosystem services, availability of surplus or deficit food and energy [1, 5]. The main game argument is that Nzoia water resources are scarce and as a consequence, the six-county governments cannot utilize everything they have within the confines of their respective geographical boundaries. They have the option to work unilaterally and compete for the scarce resources or jointly manage and distribute the cost and benefits that emanate from the Nzoia river. Food, energy, and nature are the main sectors that compete for water resources in the Nzoia river basin. Agriculture for food production is the highest consumer of the Nzoia river shared water resources [1, 3, 4, 9, 11, 14].

We designed the game to address the challenges that policymakers face while seeking to equitably distribute water resources between various sectors (mainly food, energy and ecosystem services (nature)) and amongst the various county governments sharing the water resources. The objective of the game is not to resolve the water allocation challenge but to help the players to realize the struggle for scarce water resources (between sectors and counties) and the effects this struggle might have within their respective county governments [1]. Nzoia WeShareIt game, therefore, focuses more on the process of reaching an equitable decision and not the substantive content of what the preferred decision was. The primary focus is to develop an **equitable benefit and cost-sharing framework** through player interactions and joint actions.

The Nzoia WeShareIt game aims to:

- Help policymakers realize that there is a danger of continued unilateral actions and the missed opportunities that joint water management could unlock.
- Gain insight into the concrete ways in which the Nzoia policymakers can equitably share the water resources in a manner that they all consider fair. This insight helps them to make more informed decisions while allocating resources across sectors (mainly food, energy and ecosystem services (nature)) and between the various county governments.
- Provision of a “safe rehearsal space” for new water partnership policy innovations aimed at enhancing the equitable distribution of the water resources in a manner that increases the benefits derived from the river and reduces the costs.
- Generate and test innovative policy options for water partnerships that are based on comparative advantages and shared costs and benefits, through a safe policy practice environment, for the joint management of the Nzoia River Basin.
- Gain more insight on how games can be better developed to foster water cooperation, increase team-interdependence, build trust, establish presence and increase situation awareness within complex water systems (through the game sessions and the data derived from the game research instruments).

To achieve these objectives, the overall research project generated the following questions, that we seek to answer through the application of the Nzoia WeShareIt game:

- To which extent and in what way did the Nzoia policymakers learn about the dangers of unilateral actions and the costs and benefits of jointly managing the shared water resource?
- In which way and in what direction should Nzoia decision-making on water allocation develop across sectors (mainly food, energy and ecosystem services (nature)) and between the various county governments?
- To what extent did the Nzoia WeShareIt game provide "safe rehearsal space" for the policymakers to practice the planned policy interventions before implementing them in real life circumstances?
- To what extent and in what way did the Nzoia WeShareIt game generate innovative policy options for water partnerships that are based on comparative advantages and shared costs and benefits?
- To what extent can serious gaming foster water cooperation, increase team-interdependence, build trust, establish presence and increase situation awareness within complex water systems?

2.3. The Participants

The gameplay requires at least five policymakers and a facilitator. The facilitator's role is to guide the players through the various steps of the game. We conducted the initial the Nzoia WeShareIt game sessions with the support of five facilitators (one for each player) from Moi University, in Uasin Gishu county government and Nairobi. However, we later realized that three facilitators were sufficient for the game. Two supporting two county governments each and one supporting Busia county government. The facilitators would sit in between the two players that they were guiding. The gamemaster from the Delft University of Technology coordinated all the game sessions. The game master also synchronized all the electronic aspects of the game and was responsible for closing and opening the various game rounds after all the players had completed their tasks in that particular round.

2.3.1. Policymaking Institutions Represented in Nzoia WeShareIt

The policymakers were from the county government itself and other water institutions within the county. The county government representatives were policymakers in charge of water & irrigation, energy, agriculture, and environment. The other county government institutions included representatives from Nzoia Water Services Company (NZOWASCO); The National Environmental Management Authority (NEMA); The Water Resources Management Authority; and the Water Resources Users Associations (WRUAs).

The policy makers from the following list of partner institutions actively participated in the game sessions and afterward gave constructive feedback on the game, its outcomes and the way forward.

1. Central Government (22 October 2015)
    a. Kenyan Ministry of Water and Irrigation (MWI) (Nile Basin Initiative National Officer, Groundwater Officer, Research Officer, Geologist, Senior Chemist (Water) and Water Quality Officer)
    b. Water Resources Department
    c. Moi University Centre for Public Sector Reforms (MUCPR)
    d. Moi University

2. Uasin Gishu County Government (May 3rd to 6th 2016)
    a. Uasin Gishu County Government Officials for Environment and Agriculture
    b. Kenyan Ministry of Water and Irrigation (MWI), Uasin Gishu County Office
    c. Water Towers Conservation Network (WATONE)
    d. National Environmental Management Authority (NEMA), Uasin Gishu County Office
    e. Rural Initiative for Sustainable Development (RISDEV)
    f. Sosiani Water Resources Users Association (WRUA)
    g. Eldoret Water and Sewerage Company (ELDOWAS)
    h. Water Resources Management Authority (WRMA), Uasin Gishu County Office
    i. Youth Parliament (Bunge)
    j. Wetlands Management
    k. Moi University Centre for Public Sector Reforms (MUCPR)
    l. Moi University

3. Busia County Government (11 and 12 July 2016)
    a. Busia County Government Officials for Water, Environment, and Agriculture
    b. National Environmental Management Authority (NEMA), Busia County Office
    c. Busia Water Resources Users Association (WRUA)
    d. Busia Water and Sanitation Company (BUWASCO)
    e. Lunabo Water Resources Users Association (WRUA)
    f. Moi University

4. Kakamega County (15th July 2016)
    a. Kakamega County Government Officials for Water, Environment, and Agriculture
    b. National Environmental Management Authority (NEMA), Kakamega County Office
    c. Moi University

5. Bungoma County (18 and 19 July 2016)
    a. Bungoma County Government Officials for Water, Irrigation, Fisheries, Environment and Agriculture
    b. Lake Victoria North Waters Services Board (LVNWSB)
    c. National Environmental Management Authority (NEMA), Bungoma County Office
    d. Nzoia Water Services Company (NZOWASCO), Bungoma County Office
    e. Moi University

6. Trans Nzoia County (21 and 22 July 2016)
    a. Trans Nzoia County Government Officials for Water, Environment, and Agriculture;
    b. Nzoia Water Services Company (NZOWASCO) – Kitale Office
    c. National Environmental Management Authority (NEMA), Trans Nzoia County Office
    d. Kenya Forest Service (KFS)
    e. Water Resources Management Authority (WRMA), Trans Nzoia County Office
    f. Moi University.

2.3.2. Participant Demographics

Each day there were five (5) participants from the policymaking institutions. Some days had more than five participants, and we had to decide whether they would play as teams or some participants would be requested to come on another date. The country government representatives were from different offices representing different sectors (Water, Environment, Irrigation, Fisheries, and Agriculture). Each sector under the county government was represented by a different policymaker who is an expert in that particular sector. Therefore, the county government representatives were more than one depending on the sector they work in and were representing. On most of the days, there were only five players. For all the July game sessions of the Nzoia WeShareIt game, there were five (5) policymakers, one (1) game master (from the Delft University of Technology) and three (3) facilitators (students from Moi University, Eldoret, Kenya).

Most of the participants were male (23 players). Only 12 players were female (Table 1). Some counties like Trans Nzoia and Busia had a higher representation of female players, and in some sessions, the females outnumbered the male players. However, in general, the number of male players was much higher than females in most of the game sessions (Table 1).

Table 1: **Gender * Age Crosstabulation**

			Age					
			18 to 24	25 to 34	35 to 44	45 to 54	55 to 64	Total
Gender	Female	Count	2	7	2	1	0	12
		% within Gender	16.7%	58.3%	16.7%	8.3%	0.0%	100.0%
		% within Age	50.0%	63.6%	28.6%	10.0%	0.0%	34.3%
		% of Total	5.7%	20.0%	5.7%	2.9%	0.0%	34.3%
	Male	Count	2	4	5	9	3	23
		% within Gender	8.7%	17.4%	21.7%	39.1%	13.0%	100.0%
		% within Age	50.0%	36.4%	71.4%	90.0%	100.0%	65.7%
		% of Total	5.7%	11.4%	14.3%	25.7%	8.6%	65.7%
Total		Count	4	11	7	10	3	35
		% within Gender	11.4%	31.4%	20.0%	28.6%	8.6%	100.0%
		% within Age	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
		% of Total	11.4%	31.4%	20.0%	28.6%	8.6%	100.0%

The player's ages varied from the 18 to 24 age range to the 55 to 64 age range (Table 1). The highest number of players were in the 25 to 34 age range (11 players), followed by the 45 to 54 age range (10 players) and then the 35 to 44 age range (7 players). The highest and lowest age brackets had the lowest number of players (only 3 and 4 for the 55 to 64 and the 18-24 age brackets, respectively)

Table 2: **Gender * Education Crosstabulation**

		Education					
		Completed primary education	Completed secondary education	College Diploma	Bachelor's Degree	Master's Degree	Total
Gender	Female	1	1	1	8	1	12
	Male	0	3	6	12	2	23
Total		1	4	7	20	3	35

Most of the players had completed their bachelor's degree (20 players). Only one female player's highest level of education was primary education. One female player and three male players' highest level of education was secondary education. Three players had completed a Master's degree, and seven players highest level of education is a college diploma. No player had completed a doctorate (Table 2).

2.4. The Scenario Setting / Description Tools

The Nzoia WeShareIt scenario is complicated that we could not effectively communicate it through the use of a single tool. Therefore, we developed multiple scenario description tools which widened our options for better communicating what the game is, its objectives, elements and how to play the game.

At the start of the game session, we used a combination of scenarios setting tools, designed to help the players better understand the game context and their role in the game. These options are:

1. The game rules card (mandatory, please refer to Fig. 3);
2. Face to face (one on one) interactions between the facilitators and the players (mandatory);

3. A short film prepared using the Nile WeShareIt game session (by the Ministry of Water and Irrigation) that explains the same content in the games rule card and additional information on its application in Nairobi, Kenya [7] (optional);
4. A PowerPoint presentation explaining the game elements and how to play the game (optional);
5. A how to play film prepared by the Delft University of Technology that explains the game elements and how to play the game in detail (optional); and
6. The facilitator's guide and games rulebook (detailed book on the game).

It is sufficient to explain the scenario using a combination of the game rules card and face to face explanations coupled with either a short PowerPoint presentation or a video. At the start of the Nzoia WeShareIt game sessions, we used PowerPoint presentations combined with the rules card and face to face interactions. However, later in the game, we replaced the PowerPoint presentation with the short film on the Nile WeShareIt game played in Nairobi, Kenya by the Ministry of Water and Irrigation.

2.5. The Contents of the Game

To maximize the advantages of a hybrid board game, we designed Nzoia WeShareIt with both physical, and virtual game elements. The physical items improve physical play while the virtual items enhance virtual play. The players can simultaneously touch and utilize the game items in the physical realm with direct feedback of the consequences of their actions in the virtual realm [15]. This sub-section will detail the physical and the virtual game elements.

2.5.1. Nzoia WeShareIt Physical Game Elements

The physical items in the Nzoia WeShareIt game are:

1. Five playing fields for the five county governments in the Nzoia River Basin
2. Five game rules cards (information sheets) to provide details on the game specifications and rules
3. Parcels allocated to Food, Hydro-electric power, and Nature.
4. Solar cars to represent solar power projects.

2.5.1.1. Five playing fields for five county governments

There are five playing fields or boards in the game. Each board represents a particular county government within the Nzoia river basin. The county governments represented by the playing fields are Trans-Nzoia, Uasin-Gishu, Kakamega, Bungoma, and Busia. Each player or group of players (in multiples of 5) receive a board of one county government. The board contains a map of the county government on the right and water circles on the left (Fig. 2)

The number of water circles in the playing fields is different for every county government. The number of water circles represent a county's relative share of Nzoia river water, based on hydrological features. The upstream counties (Trans Nzoia and Uasin Gishu) have fewer water circles because the water emanates from these counties at very high altitudes that a significant amount flows out of the county's geographical boundary through gravitational force. The middle-stream counties have relatively the same amount of water circles (Bungoma and Kakamega). Busia, the only downstream county in the game, has the highest amount of water

circles. Busia retains a significant portion of the Nzoia water in the Budalangi and Yala swamps.

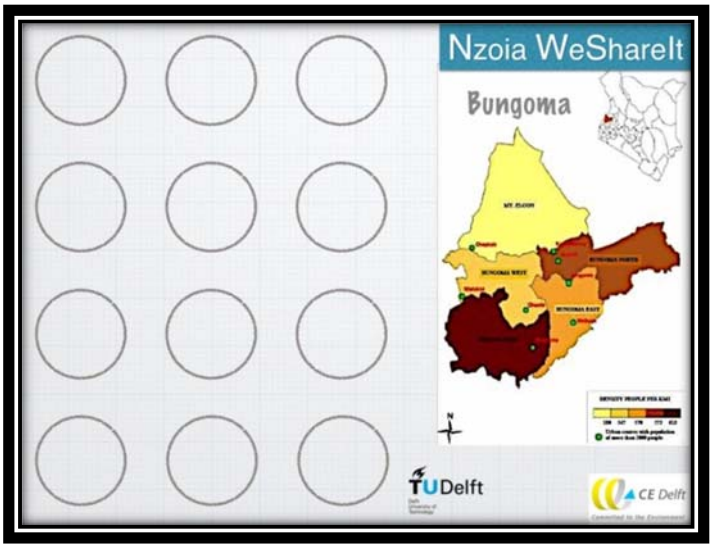

Fig. 2 Playing Field for the Bungoma County with 12 water circles

The number of circles limits the player's resources. Thus, the game restricts player's decisions to the amount of water available in their county government. The circles represent the water available for delivering ecosystem services and producing food and energy. The players cannot change their allocation (number of circles allocated for each playing field) throughout the game. Table 3 illustrates the predetermined water distributions.

Table 3: Number of circles or squares for each Playing field

Playing Field	Kakamega	Trans Nzoia	Busia	Bungoma	Uasin Gishu
Number of circles	11	7	20	12	6

2.5.1.2. Five game rules cards (information sheets)

All the players receive the game rules card, at the start of the game (Fig. 3). This card contains information on trade prices, how to calculate the happiness factors, county properties, food, and energy productivity factors, starting resources, the conversion of energy and nature parcels, the basin level strategies, the general rules and calculations and the flow of the game (steps of play).

Each county has different information on the left side of the game rules card for its government. The right-hand side of the rules card contains similar information for all the county governments. During the final stage of the Nzoia WeShareIt, most of the information on the left-hand side of the rules card was available electronically, thereby reducing the rules card to half, with only the information on the right-hand side.

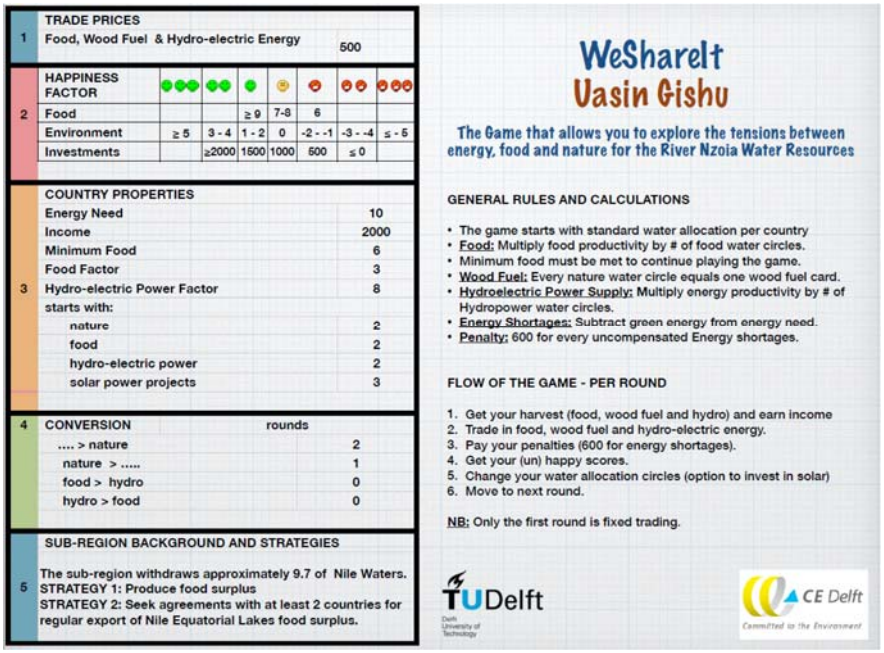

Fig. 3 Screenshot of the Nzoia WeShareIt game rules card

2.5.1.3. Parcels allocated to Food

To play the game, the players make water allocation decisions by placing the parcels on the water circles within the playing fields. There are three types of parcels: food (red); hydro-electric power (blue) and nature (green). [1].

There are five classifications of food parcels, according to how productive the county government's land is. A low food factor indicates that the parcel of land is not productive, whereas a food factor of 4 represents a fertile land. Trans-Nzoia is considered to be one of the most fertile county governments in Kenya. Therefore, we allocated Trans-Nzoia with the food factor 4. The face (upper side) of the red parcels contains avocados and the food factor for a specific county government (see Fig. 4 (a)). The parcels of food are divided as follows:

1. 12 parcels of food factor 1
2. 22 parcels of food factor 1,5
3. Eight (8) parcels of food factor 2
4. Six (6) parcels of food factor 3
5. 12 parcels of food factor 4

2.5.1.4. Parcels allocated to Hydro-electric power

There are three classifications of energy parcels, according to the energy productivity of the county government. A low energy factor indicates that the parcel of water is not productive as an energy provider, whereas an energy factor of eight represents a productive water parcel. Uasin-Gishu is considered to be one of the most productive hydro-electric power generation county governments in Kenya. Therefore, we allocated to Uasin-Gishu the energy factor of eight. The face (upper side) of the blue parcels contains either a hydro-electric power plant or

a light-bulb and the hydro-electric energy factor for a specific county government (see Fig. 4 (b). There are three types of energy parcels, namely:

1. 32 parcels of energy factor 1
2. 19 parcels of energy factor 1,5
3. seven parcels of energy factor 8

4. (a) (b) (c) (d)

Fig 4: Images of the physical game contents of Nzoia WeShareIt. (a) Food Parcel; (b) Hydro-electric power Parcel; (c) Nature Parcel; and (d) Solar Power Car.

2.5.1.5. Parcels allocated to Nature

There are 69 parcels of nature, with no productivity factor. The nature parcels contain a yellow flower with no number on any of the parcels (see Fig. 4 (c). The game calculates nature as a source of energy by summing up all the nature parcels. The energy factor for each nature parcel is always one, as nature provides energy in the form of firewood or charcoal.

2.5.1.6. Solar cars to represent solar power projects

In addition to hydro-power parcels, there are 30 solar cars, which represent solar production projects. The solar cars have no number on them (see Fig. 4 (d). The game calculates solar as a source of energy, by summing up all the solar cars. The energy factor for each solar car is always one. The game may also allocate an initial number of solar power projects to respective counties, at the start of a game. These solar projects are not limited to the number of parcels allocated. Therefore, the players can increase their initial solar power allocation to any amount, depending on the availability of money to purchase the solar power projects.

2.5.2. Nzoia WeShareIt Electronic Game Elements

There are two main electronic elements, money and emoji faces. Money plays a vital role throughout the game and is automatically calculated based on player actions. Emoji faces are also automatically calculated and displayed at the end of every round. Both money and emoji faces are cumulative and carried over to the subsequent round.

2.5.2.1. Money

County governments start the game with a fixed starting income ranging between 0 and 6500 Euros. At the beginning of every round, they receive the same amount of starting income. Players can use this money in the following ways, to:

1. Buy food
2. Buy hydro-electric power
3. Purchase solar cars (solar power projects)
4. Pay penalties, if they have an energy shortage
5. Invest in public services.

In addition to the starting income, county governments get 500 Euros for every conversion of nature parcel to either food or hydro-electric power parcel. Unused income is carried over to the next round.

2.5.2.2. Happy Emojis

In the game, there are three kinds of faces: happy, neutral and unhappy. Happy faces are issued electronically in three circumstances when the county government:

1. Food supply surpasses its residents' food wants.
2. Energy supply surpasses its residents' energy wants.
3. Amount invested in public services surpasses its residents' investment wants.

2.5.2.3. Neutral Emojis

Neutral faces are issued electronically in three circumstances when the county government:

1. Food supply is equal to its residents' food needs.
2. Energy supply is equal to the residents' minimum energy need.
3. Amount invested in public services is equal to the residents' minimum investment need.

2.5.2.4. Unhappy Emojis

Unhappy are issued electronically in three circumstances when the county government:

1. Food supply is below to its residents' food needs but above the minimum food. All players should ensure that they do not fall below the specified minimum food requirement for their county government, or they may not be allowed to continue playing the game.
2. Energy supply is below residents' minimum energy need.
3. Amount invested in public services is below residents' minimum investment need.

2.6. The Objectives in the Game

The players have one fundamental objective in the game; to gain as many "happy faces" as possible. The policymakers get happy faces when they make their residents happy. The county governments gain "happy faces" through increased food and energy supply and investment of a certain amount, in public services.

Additionally, the players have a shared goal to jointly manage the basin sustainably and equitably, while maximizing the benefits and reducing the costs. Therefore, the policymakers have to determine to what extent they can make their resident's happy without negatively competing with the shared goal. Since they share the water resource, their decisions may also be influenced by other factors (like maintaining good relations with their neighbors), beyond their responsibilities to their county residents. The game provides the players with the flexibility to redesign the game, to take into account other factors that influence their water allocation decisions.

2.7. Cycles and Steps of Play

While playing the game, there are two types of cycles that the players experience. The macro and micro-cycle. This sub-section will describe how we incorporated the two types of cycles in detail, in the Nzoia WeShareIt game.

2.7.1. The Macro Cycle

The duration of one game session is half a day (typically played in the morning). The players conclude the game after an agreed set of cycles or rounds or at a pre-determined time. If there is no agreed time, the facilitator has the power to stop the game at any time. After concluding the game, there is a brief debriefing session to reflect on the gameplay, outcomes, lessons learned and recommendations.

The game consists of a series of rounds or cycles (maximum 8). The first three rounds or cycles are regular rounds, followed by a drought round (Fig. 5).

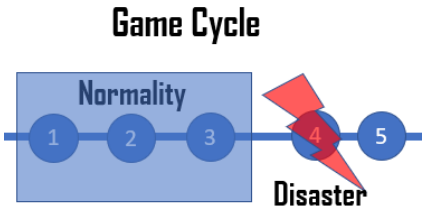

Fig 5: Image of the Nzoia WeShareIt macro game cycle, indicating the regular rounds and the drought round (round 4).

After the drought round, the game returns to regular rounds. At the lapse of every three rounds, there is a drought round. We designed the game so that players can play as many rounds as they wish. However, in practice players play between five and eight rounds within the half day time allotment. We attained the planned game outcomes within a half day play session, and there was no added value of continuing with the game, in the afternoon, with the same players.

2.7.2. The Micro Cycle (Five Steps of Play)

Each round consists of five steps of play, namely:

1. **HARVEST:** The players get their harvest in the form of food parcels, hydroelectric energy parcels, nature parcels, solar and income.
2. **TRADE:** They trade in food and hydroelectric energy.
3. **PAY PENALTY**: A penalty of 600 Euros is payable for every unit of energy shortage, in the current round.
4. **INVEST:** The county government may invest in public services and/or solar power projects or not take any action. After that, the players assess the results, as displayed on their respective iPads and plan the next strategy, individually or with the group.
5. **RE-ALLOCATE:** Finally, the players may make water re-allocations decisions, also known as conversions.

2.7.2.1. Harvest

Harvest refers to a summation of total resources at the start of a particular round, before entering into the trading round. The game has five types of resources:

1. Income
2. Food
3. Hydro-electric energy
4. Solar energy
5. Nature as an energy resource (wood fuel)

The game allocates water parcels to food, hydro-electric power, and nature. The overall allocation also involves other resources like income and solar energy, that are not limited to the number of water circles. The facilitator explains the allocation rules in detail and provides the players with the opportunity to arrange their respective boards according to the pre-determined initial allocation.

The game starts with a standard water allocation per county government, which was determined based on some factors as documented in Appendix I and II. These factors comprised of population density, hydrology, energy access levels, water access percentages, county government income levels, agricultural potential and hydro-electric energy production and potential. The game also starts with a predefined amount of income to all the county governments, at the start of every round. Table 4 provides the information regarding the income.

Table 4: Predefined Income for each County Government

Playing Field	Kakamega	Trans Nzoia	Busia	Bungoma	Uasin Gishu
Income	0	1000	6500	5000	2000

The players calculate food by multiplying the food factor with the number of parcels allocated to food. Figure 6 (b), is a real-time record of Trans Nzoia's allocations and resources. Based on the county government's allocation, Trans Nzoia has a food factor of 2, and a food allocation is 4. Therefore, its total available food at the start of the round was 6 (3 parcels x 2 food factor). However, its current food resource is 12, which indicates that Trans Nzoia County bought six units of food, in that particular round.

(a) (b)

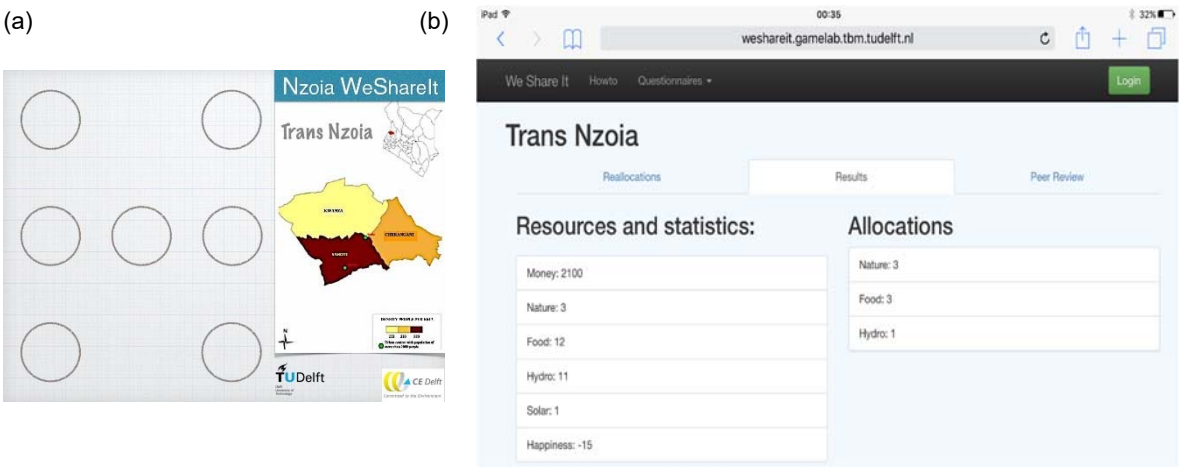

Fig. 6 (a) Playing Field for the Trans Nzoia County Government with seven water circles; and (b) Screenshot of Trans Nzoia County Government, indicating its resources and allocations

The players calculate hydro-electric energy by multiplying the hydro-electric energy factor with the number of parcels allocated to hydro-electric energy. Trans Nzoia has a hydro-electric energy factor of 8, and its current hydro-electric energy allocation is 3 (Fig. 6 (b)). Therefore, its total available hydro-electric energy at the start of the round was 8 (1 parcel x 8 energy factor). However, its current hydro-electric energy resource is 11, which indicates that Trans Nzoia County bought three units of hydro-electric energy, in that particular round.

Solar energy is a summation of all the solar cars. In Figure 6 (b), Trans Nzoia has only one solar car. Therefore their solar energy is one. Nature energy (wood fuel) is a summation of all the nature parcels. In Figure 6 (b), Trans Nzoia has only three nature parcels. Therefore their nature energy is three.

2.7.2.2. Trade

Trading is done electronically with the units of food or energy (Fig. 7), and not physically with the parcels. During the trading round, the players are allowed (but not obliged) to move around the room with their iPads, looking for buyers of surplus food or hydro-electric power. The players can also look for sellers if they have a food or energy shortage. Some players may not have food or energy shortage but would like to trade to increase their happiness results. Once a trade has been made, the players are expected to record their trades electronically using their iPads (Fig. 7).

Fig. 7 Screenshot providing record of trade exchanges

The players only record what they have given out and not what they have received. We adopted this recording system to avoid double processing of the same transaction. Therefore, in the iPad, the player can see all the transactions that they have provided to other players, regarding food, energy, and money (Fig. 7).

2.7.2.3. Pay Penalty

Before the game begins, the facilitator informs the players that minimum energy has to be met to avoid penalties and minimum food has to be met to continue playing the game. We predetermined the minimum food, and it is different for the different counties (Table 5). We determined the minimum food for each county government by considering several factors including demographics, income levels, and agricultural productivity levels. The game warns

players when they have a food shortage (Fig. 8). The game also calculates food shortage or excess, by subtracting minimum food from the total food.

Table 5: Predefined Energy Need and Minimum Food for each County Government

Playing Field[4]	KK	TN	BS	BU	UG
Energy need	4	5	18	15	10
Minimum food	2	4	12	5	6

The facilitator also explains to the players how the game calculates penalties. The game always warns players, when they have an energy shortage. Also, the game calculates in real-time the amount of penalty that is payable (Fig. 8). Penalty fees are 600 Euros per unit of energy shortage. The players can calculate their energy shortage by subtracting energy need from the total energy. The penalty is payable immediately after trading with other county governments and before any purchase of solar projects or investments are made.

Fig. 8 Screenshot of a warning of food and energy shortage and the amount of penalty

If the county government still has an energy shortage, the game automatically deducts the penalty at the close of the trading round. If the available income is lower than the penalty, the game deducts the penalty from the income in the subsequent round.

2.7.2.4. Invest

The players can select to invest in one of following public services: Education, Agriculture, Energy, Finance, Infrastructure, Security, Health, Transport, ICT and Water (Fig. 9). This list was determined by the Kenyan stakeholders as the essential public service sectors, during the game design and testing sessions, in Eldoret, Kenya [14]. The choice of a specific public service does not affect the overall result.

After choosing which public service to invest in, the player has to choose how much to invest in this public service. The game rules determine how many happy faces a player gets for investing a certain amount of money. Therefore, it is the amount invested that determines the outcome, not the selected sector. In addition to investments, players can increase their energy generation capacity by building a solar power project for 1500 euro (one solar car). Each solar power project is worth one unit of energy.

[4] Kakamega (KK); Trans Nzoia (TN); Busia (BS); Bungoma (BU); and Uasin Gishu (UG).

Fig. 9 Screenshot where a player is selecting the investment they seek to make in public services

2.7.2.5. Reallocate

Finally, players may make water allocations decisions in the form of re-allocations or conversions. When the game starts, there is an initial water allocation made for each county government. The players can change their allocation at the end of every round. The players adjust their parcel allocations by either increasing or decreasing their total amount of food, energy, and nature.

Once, the players have concluded their water allocation decisions, the gamemaster closes the round and opens the next round. The gamemaster should be careful not to close the round until the players conclude everything, including the in-game peer review (we discuss this in the assessment section). Also, the gamemaster should be careful not to close the trading round until the policymakers record in their iPad, all the negotiated and agreed trades. Once the gamemaster closes the trading or a particular round, s/he cannot electronically return to that round or trade session.

2.8. The Roles

The roles were designed using three game mechanics for cooperation and three game mechanics for team interdependence. For cooperation, we designed the game roles around the shared goal, goal asymmetry, and goal synergy game mechanics [16-19]. For team interdependence, we designed the game roles around complementary knowledge, role asymmetry, and complementary roles game mechanics [16-18, 20-22].

To enable us to design the six (6) game mechanics, we incorporated three roles types, namely:

1. Played roles
2. Pseudo roles
3. Simulated roles

To determine which roles should be played or simulated, we assessed whether the role is purely administrative or requires individual input. We designated the administrative roles that

are constant throughout the game as simulated roles. We designated the roles that required individuals to play to enable us to assess their diverse perceptions, values, judgments, and decisions, as played roles. Finally, we assigned unique roles that were needed only for the drought round, to the gamemaster as pseudo roles.

2.8.1. The Played Roles

There are five played roles. The five players are policymakers in five county governments (Bungoma, Busia, Kakamega, Trans Nzoia and Uasin Gishu). A policymakers interpretation of his or her respective roles determines the player's actions. The game design guides the player through allocating different **resources** to each player, assigning player **goals**, providing players with different **responsibilities**, providing space for player **interests** and diverse **options**. These guides help players in interpreting their respective roles.

Regarding the resources, the game design ensures that all the five players have different starting resources (Table 6).

Table 6: The starting resources for all the county governments, their respective Income, Food, and Energy productivity factors and the prices for the initial trade, solar and penalty, in the Nzoia WeShareIt Game.

Playing Field	Kakamega	Trans Nzoia	Busia	Bungoma	Uasin Gishu
# circles or squares	11	7	20	12	6
Income	0	1000	6500	5000	2000
Energy need	4	5	18	15	10
Minimum food	2	4	12	5	6
Food factor	2	4	1,5	1	3
Energy factor	1,5	1,5	1	1	8
Starts with:					
nature	7	3	7	5	2
food	4	3	10	4	2
hydro / biomass	0	1	3	3	2
windmill / solar	0	1	0	3	3
Initial energy trade prices	500				
Penalty-energy shortages	600				
Price windmill/solar	1500				

The diverse **resources** may lead to the following player interpretations of their functions.

1. **Energy producers and suppliers** (Uasin Gishu with the highest energy productivity factor of 8)
2. **Food producers and suppliers** (Trans Nzoia and Kakamega with the highest food productivity factor of 4 and 2, respectively). Uasin Gishu may also be considered a food producer, due to their high food productivity levels. However, their energy productivity levels are much higher than food.
3. **Food and energy consumers/money suppliers** (Busia and Bungoma with the income levels of 6,500 and 5,000, respectively).

Apart from the available resources, players may take specific actions based on their perceptions of their role in accomplishing the **individual and shared goals**. The game assigns two goals to all the five players:

1. The internal individual county government goal of making their residents happy through the supply of food, energy and investing in public services.
2. The shared goal of jointly managing the shared scarce water resources sustainably while maximizing food and energy production, based on comparative advantages.

Since there is a concurrent operation of both the shared and individual goals, there may be simultaneous roles operating at any given time. The presence of multiple simultaneous roles

may lead to tensions and conflicts if the players do not focus on their comparative advantages and the overall goal of managing the basin jointly and sustainably.

The game design incorporates tensions between the individual and **shared goals**, thereby leading to healthy competition between the multiple roles assigned to each player. To ensure that the competition is healthy, we introduced the goal asymmetry and goal synergy game mechanics. **Goal asymmetry** game mechanic ensures that all players have unique individual roles assigned to them that compete with the shared goal in all the rounds. The **goal synergy** game mechanic ensures that the competition is healthy by ensuring that the assigned goals and roles are not fundamentally divergent but complementary.

All the players have an assigned responsibility to work as a team and cooperate. The game mechanics that steer the players towards these responsibilities are:

1. The players do not have the full picture of the basin and need to interact and share information to increase their situation awareness levels, and thus make more informed decisions (**complementary knowledge** game mechanic).
2. The players do not have a full picture of other player's responsibilities, niches and how they can work together to fulfill the shared goal. To get a better understanding of the game requires players to play more roles in the game, such as communicators, negotiators, and boundary spanners. These additional player roles enable the players to fulfill their assigned responsibilities and the overall shared goal. We use the **role asymmetry** game mechanic to assign different player responsibilities.
3. To ensure that there is an added value in team interdependence and cooperation we introduced the **complementary roles** game mechanics. Each player's role complements the other, for instance, food suppliers' role complements the food consumers role. This game mechanic gives purpose to the respective roles and encourages interdependence play.

In addition to the different resources, individual and shared goals and the assigned responsibilities, players perceive their roles based on **interests** and available **options.** For instance, a player may be interested in maintaining good relations with other players and thus take up the role of being a producer and supplier at reasonable prices to advance this interest.

The player interests vary depending on the game elements and personal perceptions. The player options keep on changing as the circumstances change. In the drought round resources are halved leading to a change in roles based on the limited resources and reduced player options. Therefore, a player's perceived role affects other players roles, based on previous player actions. In this complex game context, players continue to change their roles or maintain the current roles to advance or protect their interests or expand their available options.

2.8.2. The Pseudo Roles

Pseudo roles are actively played in the game but not by the policymakers (participants). The game design introduces two pseudo roles: the World Bank and the World Food Programme (WFP). The gamemaster plays the two pseudo roles in the drought round. The gamemaster introduces these roles in a game session where players do not focus on pursuing their shared goal within the first three rounds; thus they not prepared for the drought round. When the slow onset disaster strikes and their resources are halved most of the players do not have sufficient food to enable them to continue to the next round (if a player falls below their minimum food they are removed from the game). Therefore, the gamemaster acts as both the World Bank and the World Food Programme (WFP) in this round.

The World Bank allows the players to borrow money to buy food from the World Food Programme (WFP). The World Bank provides money in the form of a loan which the counties pay in subsequent rounds.

2.8.3. The Simulated Roles

Some simulated roles are inbuilt in the game. One example of such a role is the role of the Kenyan Government Treasury that issues pre-determined incomes to the county governments at the beginning of every rounds. The Kenyan Government Treasury also receives income from the county governments in the form of penalties for not meeting their energy needs. Another simulated role is the National Environmental Management Authority (NEMA) that charges a penalty for cutting down trees and destroying the environment. The simulated roles are incorporated into the game because they are an essential part of the game process. Therefore, it is not necessary for a player to be assigned some of these roles.

2.9. The Unexpected Events

Unexpected events were incorporated to introduce new elements and change the course of players thinking, within the game. These events are important because they introduce new game dynamics that disrupt normality and challenge the players to think more in-depth about the core issues, their perceptions, values, arguments, and their subsequent decisions. We also included unexpected events to encourage players to manage the shared water resource jointly and to repel them from acting unilaterally. Unexpected events also increased the Nzoia basin complexities that the players had to resolve thereby breaking the monotony and increasing uncertainty within the game.

Nzoia WeShareIt game has three types of unexpected events:

1. Planned event
2. Random events
3. Ad hoc events

2.9.1. The Planned Events

Two planned events occur unexpectedly in the fourth and eighth round of the game: the drought round and the introduction of pseudo roles played by the gamemaster.

The drought that leads to a drastic decline in food and energy is not introduced in the game scenario and occurs unexpectedly in the fourth and eighth round. Drought is introduced to assess the effect of slow-onset disasters on the present player actions, power dynamics, and the social systems. As a result of the drought, player resources significantly reduced. Therefore, players have to find solutions, individually or jointly to address the pressing needs. In this way, the game serves two significant functions. First, it is a practice ring where the players test the viability of various strategies within a safe environment. Second, it is a laboratory, where the researcher and the players can analyze the effect of disasters on the current actions, power dynamics and eventually on the social system.

Apart from the drought, the gamemaster introduces two pseudo roles in the fourth and eighth round, the World Food Programme and the World Bank as players. These roles are introduced to address the sudden gap in food resources that may threaten the ability of the players to continue playing the game. The gamemaster activates the planned event only after

establishing that some players have been severely affected by the drought and will not be able to proceed to the next round.

2.9.2. The Random Events

The players have the freedom to develop random events during the drought round to address the challenge. In some game sessions, the players seize the opportunity while in others the opportunity is not seized. In the Nile WeShareIt game session, the players seized the opportunity and convened an inter-governmental basin meeting. In the meeting, they assessed how they arrived at their current position and jointly agreed on joint actions to address their shared problem. In this game session, they devised a short-term and long-term action plan. In the short-term, they sought the help of the World Bank and international food companies to address food insecurity. In the long-term, they agreed to jointly manage the basin and ensure that their plans take into account disasters such as droughts and other forms of uncertainties.

2.9.3. The Ad Hoc Events

The gamemaster can introduce ad hoc events, on the spot, when he or she sees the need to do so. The gamemaster needs to understand the electronic game accounting system well to capture the changes as a result of introducing ad hoc events, on a real-time basis.

During the game sessions, the gamemaster can introduce some ad hoc events. For instance, the introduction of drastic reductions in the solar power project prices to increase investments in solar and boost energy production. The gamemaster introduced this event after realizing that the players barely purchased solar because of the high prices. One of the facilitators played the pseudo role of a company that produces and sells cheap solar power panels. Later the solar power projects price was changed, in the electronic game, from 2,500 to 1,500, after the ad hoc event proved to be successful.

Other ad hoc events that have been devised by the gamemaster are increases in income for specific county governments to increase their purchasing power and the reduction of available resources to increase the complexity of the game.

2.10. The Rules

There are two primary rules in the game, the trading rules, and the conversion rules.

2.10.1. The Trading Rules

The game rules determine fixed trade prices in the first round. The fixed price is 500 Euros per unit of food or hydro-electric power. The players are allowed to change the prices (lower the prices or increase the prices) in the subsequent rounds. In subsequent rounds, players are also allowed to provide food and energy for free if they deem it necessary.

2.10.2. The Conversion Rules

The conversion rules are standard for all the county governments. Players can convert food and energy immediately. To convert nature to food or energy, the player leaves the land idle for one round (referred to as “not in use” in the game). Each nature conversion to food or

energy leads to a cash increment of 500 euros, for the sale of the wood fuel collected when cutting down trees. Any conversion back to nature takes two rounds (land remains idle for two rounds). The conversion from arable land to nature takes longer (2 rounds) because it takes a lengthy period for trees to grow and mature.

2.11. Decisions

2.11.1. Inequitable Distribution of Scarce Resources

Currently, the five (5) county government make water allocation decisions at the county government level depending on the available resources (Table 6). Each county government has different:

1. **Incomes levels:** The county governments make income based on the taxes they collect from their residents and the income they derive from their natural resources (game reserves, water, national parks, beaches, the tenancy of land). Therefore, counties that are endowed with natural resources and have productive land and enough water to grow crops and produce energy have higher incomes than resource-poor counties.

2. **Food productivity levels:** Some counties have higher food productivity levels due to the fertile soils, (Trans Nzoia county government), compared to others whose productivity is low.

3. **Energy productivity levels:** Some counties have higher energy productivity levels due to the presence of large amounts of water flowing from hilly landscapes, and many waterfalls, (Uasin Gishu county government) compared to others whose productivity is low.

2.11.2. The Nzoia Basin Policy Decision Matrix

The Nzoia basin policymakers have three basic policy decision options (Fig. 10):

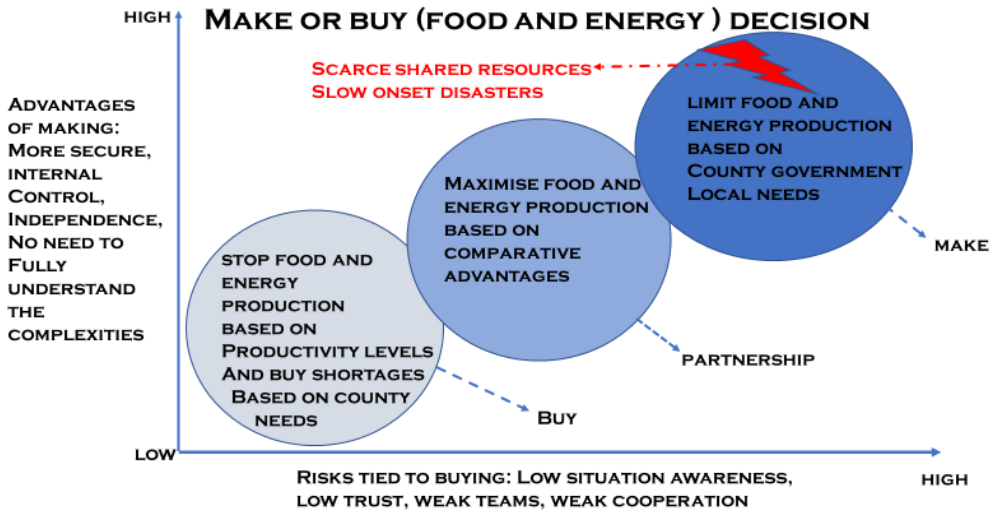

Fig. 10 Screenshot of the Nzoia WeShareIt decision matrix on making or buying (food and energy) decision

1. **Maximise** food and energy production based on comparative advantages of the various county governments.
2. **Limit** food and energy production to the bare minimum that is required to meet the county government citizen needs.
3. **Stop** focusing on food and energy production based on productivity levels and buy the shortages from other county governments.

2.11.3. Uasin Gishu County Government Policy Decision Options

We use the Uasin Gishu county government case to illustrate the three decision options (Table 6). Uasin Gishu has a high energy and food productivity factor (8 and three respectively), but their water allocation is too low to produce both food and energy, for the entire basin (they have only six water circles). Therefore, Uasin Gishu has to decide whether to:

- **MAKE** its food and **LIMIT** its energy production (not **BUY** anything). This decision enables Uasin Gishu to meet all its local needs within the confines of its geographical boundary with little or no consideration of the basin's needs and interests.
- **STOP** "nature" by cutting down trees and destroying all the nature to **MAKE** BOTH food and energy (not **BUY** anything). This decision helps Nzoia to be self-sufficient and independent, and at the same time address, some of the basin's needs, at the expense of its environment.
- **MAXIMISE** food production and **STOP** energy production (**BUY** energy). If Uasin Gishu focuses only on food production, it has to rely entirely on other riparian states to provide energy for its residents, at an agreed price.
- **MAXIMISE** energy production and **STOP** food production (**BUY** food). If Uasin Gishu focuses only on energy production, it has to rely entirely on other riparian states to provide food for its residents, at an agreed price.

Two factors that limit a player's decision to make their food and energy is the scarce water resources and natural disasters. Each player has a limited number of water circles and has to make their decisions within the confines of their water resources. Second, after every three rounds, the player's resources are halved, when a slow onset disaster strikes (drought). The sudden and drastic decline in player resources profoundly and negatively affect their ability to make their food and energy.

2.12. Indicators and Assessment Criteria

2.12.1. Allocations, Resources and Calculation of Total Food and Energy

The county governments can redesign their government, within the constraints of the financial and water circle restrictions. The initial allocations and resources are fixed and different for every county government. Busia's initial water allocation is 20 circles. In round 11 (Fig. 11), the 20 circles are allocated as follows: 10 circles for food (food factor 1.5) and seven circles for hydro-electric energy (energy factor of 1) and three circles to nature. Busia has no solar power projects.

Total energy is a summation of hydro-electric energy, nature energy, and solar energy. For example, in Figure 11, Busia has a hydro-electric energy factor of 1. Therefore, its total

available energy at the start of round 11 is 10 (7 hydro-electric energy + 0 solar energy + 3 nature energy).

The yellow text is a warning to Busia that they need to purchase more energy or pay the penalty. They currently have ten hydro-electric units and require 18 to meet their citizen's needs. Busia needs to buy eight energy units in the form of hydro-electric energy, in that particular round or pay a penalty of 4,800 (8 energy shortages x 600 penalties per unit).

	Allocations	Factor	Starting Resources	Minimum	Current Resources
Money	-	-	12700	0	7900
Food	10	1.5	15	12	15
Not in use	0	-	-	-	-
Nature	3	-	3	-	3
Hydro	7	1.0	7	-	7
Solar	0	-	0	-	0
Total Energy		-	10	18	10

Fig. 11 Screenshot of Busia County Government in Round 11. The details regarding the money, food, nature, hydro and solar are provided, for every round.

The starting income in round 11 is 12,700 euros. However, after the deduction of a penalty of 4,800, the current income is 7900 euros. To reduce the penalty paid, Busia has to increase its energy from 10 units to 18 units. Busia could use the same amount of penalty money (4,800) to buy hydroelectric power during the trading round. However, depending on the market value of energy, Busia may pay less or more.

Busia's primary challenge is to negotiate and agree with other county governments to produce excess energy and sell their excess units to Busia. Busia cannot address the resource scarcity challenge unilaterally. It requires prior negotiations with other county governments on how much water parcels to allocate to food, energy, and nature to be able to produce surplus food and energy and the prices they are willing to sell the surplus. In some instances, the county governments that have high energy productivity levels may refuse to produce excess energy because they may not trust other county governments to keep their promise of purchasing the excess or in some instances, produce their food. There were many instances in the game where agreements were made in the previous round and broken during the trading because one player got a better buyer or the other increased the prices, without prior notice. Therefore, in round 10, Busia has first to study the situation, identify a county or counties that may be prospective suppliers and convince them to produce surplus energy to enable Busia to purchase the surplus from them, for a particular price. At the start of round 11, Busia county government has exceeded its minimum food by three units. If Busia county government, sells its food and falls below 12, they may not be allowed to continue playing the game.

2.12.2. Calculation of the Happiness Results

The players assess the results, as displayed on their respective iPads and plan the next strategy, individually or with the group. The electronic game provides the results, indicating how many happy faces each county government scored in that particular round.

The happiness factor indicates how the policymaker can satisfy his or her residents. Each county government relies on a county-specific happiness factor table, to inform the player decision on how much food, environment (energy surplus or shortages) and investments are needed to gain “happy faces.”

(a)

2	HAPPINESS FACTOR							
	Food			≥ 9	7-8	6		
	Environment	≥ 5	3 - 4	1 - 2	0	-2 - -1	-3 - -4	≤ - 5
	Investments		≥2000	1500	1000	500	≤ 0	

(b)

Fig. 12 (a) Happiness factor table for one of the county governments (b) Screenshot indicating the happiness results in food, energy, and investments.

Figure 12 is a happiness factor table, for one of the county governments. This particular county government can get the highest happiness factor by investing 2000 in public services, ensuring it has nine units of food and its energy surplus should be 5. Investments in public service above 2000, does not increase the happy faces. After attaining a certain amount of food, energy and public service investments, the citizen’s happiness is not affected. If the county government still has an income after reaching the maximum number of happy faces for that particular round, they can invest in solar power projects or save the money for future use. On the other hand, food units below 7, any energy shortage and investments below 1000 euros, attract unhappy faces. The yellow face is neutral and does not attract a happy or unhappy face.

The game calculates the happiness factor by summing the happy faces and unhappy faces. The players gain happy faces when they increase their total food, energy, and investment in public services, in every round. In figure 12 (b), the happy face calculation for that specific round is 0. The game provides a table of cumulative happy face results, separately, in the results section. This information helps the players to assess how they have performed cumulatively.

2.13. Data

We collected data through seven (7) research instruments. These instruments were the: pre-game, in-game and post-game questionnaires (Fig. 13); an inbuilt data collection mechanism; observations, video recording, and the debriefing session. The facilitators and game-master recorded their observations throughout the game, and there was a rough-cut video recording of the entire game session.

2.13.1. Pre-Game, In-Game, and Post-Game Questionnaires

The questionnaires are accessed through a drop-down button at the top left corner of the players' iPads, as illustrated in Figure 13.

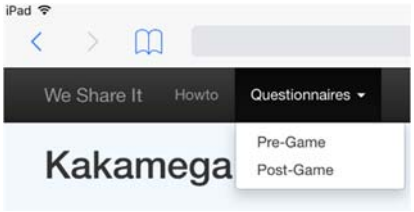

Fig. 13. Screenshot indicating where the pre-game and post-game questionnaires can be accessed

2.13.1.1. Pre-Game Questionnaire

We divided the pre-game questionnaire into three main parts. The first part collected data on the participant's background (county they represent, age, gender, organization, their highest level of education and email). The second part collected data on their current perception of the water management situation, in the Nzoia Basin (instability, complexity, variability, arousal, spare mental capacity, concentration, a division of attention, information quantity, information quality and familiarity with the situation). The last part assessed their trust and trustworthiness levels, at the start of the game.

2.13.1.2. In-Game Questionnaire

The in-game questionnaire entails one question with 16 parameters. We grouped the 16 factors into four parts (time, place, action and relation). The in-game questionnaire was translated into Swahili, to increase the understanding of the in-game assessment tool by the policymakers. The players were requested to assess their perception of at-least two players on a scale of 1 (for low) and 10 (for high) using sliders. We incorporated the in-game questionnaire within the game and chose to use sliders so that players can quickly input the data by sliding left or right.

2.13.1.3. Post-Game Questionnaire

We divided the post-game questionnaire into twelve (12) primary parts. First, questions to assess change in players awareness of the Nzoia basin water allocation and climate change situation. Second, an assessment of the game quality. Third, players perceptions on the contribution of the game to problem-solving and skills development. Fourth, players experience the game world, story and identity development. Fifth, players experience in the game with building and modifying the game. Sixth, an assessment of the social interactions in the game. Seventh, players motivation to continue playing the game. Eight, players analysis of the level of cooperation in the game. Ninth, an assessment of the learning component of the game. Tenth, analysis of the level of trust or distrust, during the gameplay. Eleventh, an assessment of the use of computer applications to support the game. Finally, players rating on their satisfaction with the game and any additional feedback.

2.13.2. Inbuilt Game Data

The inbuilt game is designed to collect numerical data from the trading, purchase of solar, investment and water allocation decisions, for every round. Also, there is data on the trading partners, the trade price, and the traded goods. The game automatically collates the data and reflects it in inbuilt game graphs.

The game visualizes the inbuilt game data through four principal graphs. The first graph indicates the happiness results of the five county governments for every round. The second graph tabulates the investments made by all the five county governments, for every round. The third graph demonstrates the changes in water allocation decisions that increase or decrease food, energy, nature and “not in use” (land left idle while converting to food or energy). The last graph visualizes the amount that county governments allocated for hydro and solar energy, in every round. The facilitator projects these graphs on the screen (throughout the game session) and the information changes real-time on the screen.

2.13.3. Debriefing Session

During the debriefing session, each county government was requested to express their impressions of the experiences they faced during the game, lessons learned and proposals to improve the game design and process. The debriefing session is usually very brief and informal. In these sessions, the participants reflected and gave useful general observations and recommendations. They also provided comprehensive recommendations on the proposed way forward.

2.13.4. Game Observations

The observations during the gameplay were collected by writing short notes on some predetermined factors. The list of factors includes;

- The gameplay in general;
- The interactions and self-organization of the players;
- The chosen content and policy measures; and
- The problems identified and the strategies that were undertaken to resolve these problems.

2.13.5. Video Recording

There are two kinds of video data that we produced. First, the unedited rough-cut video data for all the seven Nzoia WeShareIt game session and the Nile WeShareIt game session. This data form is significant and covers the entire half day game session. We collected this data to assess whether the game increased cooperation amongst the players. The second set of video data was a short video clip of the Nile WeShareIt game (8 minutes), which we used as one of the scenario description/setting tools, at the beginning of the game sessions.

2.14. Computer Equipment, Accessories and Paraphernalia

To play the Nzoia WeShareIt game, we ensured that the select hotel had high-speed Wi-Fi internet access. We also had the following eight groups of computer equipment or accessories.

1. **Two Laptops:** The game-master and facilitator had laptops. The game-master controls the rounds and checks the game inputs and outputs. The facilitator uses the laptop to project the presentation, the game findings, and the leaderboard.
2. **Five iPads:** There were five iPads for each of the five county government policymakers. We had small and portable iPads to enable the policy makers to easily carry them around the room as they negotiate with the other county governments.
3. **Two screens:** A screen for the initial presentation to introduce the game and later for the projection of the leaderboard. It would be more beneficial if there are two screens to project the game results on one in the form of graphs and the other projects the results of the leaderboard for every round. These two screens project the game findings on a real-time basis.
4. **Two projectors:** If there are two screens in the meeting room, then the session also requires two projectors to project the content on the two screens or a projector that is capable of displaying different information on the two screens.
5. **Back-up internet solutions**: We carried backup internet solutions because the hotel internet in some places was not stable. We used a backup modem from Safaricom service provider and two standby iPhones as personal hotspots. Backup internet was essential because most of the areas where the game was applied had unstable internet and this could affect the seamless gameplay and the overall results.
6. **The stand-alone power system (SAPS or SPS**): One of the pre-requisites of selecting the host hotel was it must have a stand-alone power system (SAPS or SPS), in the form of a standby generator.
7. **Power banks:** Also, we carried power banks, because the standby generators take time to initiate after a power-cut. The power banks were essential to bridge the time gap between the power-cut and the installation and running of the standby generator to ensure seamless play. We took these measures because the Nzoia basin faces regular power rationing or power shortages.
8. **Video recorder**: We had a video recorder to document the findings. We mounted the video recorder in a high position that captures the whole room because during the trading round the players would walk and negotiate all around the meeting room and we wanted all these interactions captured.
9. **Sound system:** We carried a sound system to support the video recording and cancel the noises in the background.
10. **Paraphernalia:** In addition to the computers and accessories, we also used other tools during the gaming sessions that we refer to as paraphernalia. The paraphernalia included: registration forms, notebooks, pens, one calculator, one stopwatch, and nametags.

2.15. Rules for the Implementation of the Game

The game rulebook contains a description of all the rules of the game. By using the game rulebook, it may be possible to play the game with a game master only and without a facilitator. However, playing the game without a facilitator and student support, slows the pace of the game. We divided the Nzoia WeShareIt Rule Book into the following seven parts:

1. Objectives of the game;
2. Game Contents;
3. The goal of the game;
4. Game Information on the Boards;
5. Game Rules;
6. The Flow of the game; and
7. Game Design background information.

3 The Publications

3.1. The General Game Findings

The game assessment data provided a general picture of the contribution of the game to the learning processes of the participants and delivered several policy options that the Nzoia river basin stakeholders may consider. The general feedback from the game assessments indicated that serious gaming holds a promise as a learning tool, a safe rehearsal space for proposed policy options and emerging innovations. Serious gaming also supported the development of an equitable benefit and cost-sharing framework, in complex shared water systems.

Through the game data we have sufficient evidence to demonstrate that the policymakers understanding increased on the:

- The danger of continued unilateral actions and the missed opportunities that joint water management could unlock.
- Concrete ways in which the Nzoia policymakers can equitably share the water resources in a manner that they all consider fair. This insight helped them to make more informed decisions while allocating resources across sectors (mainly food, energy and ecosystem services (nature)) and between the various county governments.

3.2. The Published Works

In the course of the design and application process, we have published some scientific articles, conference articles, and electronic articles. However, a more substantial part of the planned scientific publications is incomplete. This part of the report will provide a list of the already published works under this project and the planned scientific publications.

3.2.1. Already Published Works

1. Onencan, A., et al. *WeShareIt Game: Strategic Foresight for Climate-change Induced Disaster Risk Reduction*. in *Humanitarian Technology: Science, Systems and Global Impact 2016, HumTech2016*. 2016. Boston, USA: Procedia Engineering.
2. Enserink, B. and A. Onencan, *Nile Basin Scenario Construction.* 2017.
3. Onencan, A., et al. *Coupling Nile Basin 2050 Scenarios with the IPCC 2100 Projections for Climate-induced Risk Reduction*. in *Humanitarian Technology: Science, Systems and Global Impact 2016, HumTech2016*. 2016. Boston, USA.
4. Onencan, A.M. and B. Enserink *THE NILE BASIN BY 2050: Strategic Foresight on the Nile Basin Water Governance*. 2014. 28.
5. Onencan, A., et al., *MAFURIKO: Design of Nzoia Basin Location Based Flood Game.* Procedia Engineering, 2016. **159**: p. 133-140.
6. Onencan, A.M., *TU Delft serious game elevates Nzoia*. 2017.
7. Onencan, A., et al., *Weshareit: A Nexus Approach To Nile Basin Water Resources Management.* Decision making under deep uncertainty, 2015.
8. Onencan, A.M., *WeShareIt Video for the Ministry of Water and Irrigation Game Session*. 2015: Nairobi, Kenya.

3.2.2. Accepted Scientific Publications that are not yet Published

1. *We developed a paper that assesses the applicability of the post-game questionnaire assessment framework on a hybrid board game. This paper was double-blind peer-reviewed and presented at the 2017 ISAGA Conference. The paper will be published in Springer in early 2018 as an ISAGA 2017 Conference Proceeding.*
2. *We have also developed a paper that outlines the Nzoia WeShareIt conceptual framework and discusses why and how we incorporated Disaster Diplomacy into the game design. This paper was double-blind peer-reviewed and presented at the 2017 ISAGA Conference. The paper will be published in Springer in early 2018 as an ISAGA 2017 Conference Proceeding.*
3. *We conducted literature review wrote a paper that assesses the contested knowledges within the Nile Basin. This paper has been submitted to the MDPI Water Journal and was peer-reviewed. We are currently revising it before resubmission.*

3.3. The Planned Publications Currently in Draft Format

We plan to present and discuss the detailed results in subsequent peer-reviewed scientific publications. These publications will assess the contribution of the game to trust-building, situation awareness, team interdependence, cooperation, presence and social learning. Process-based papers will assess the effect of various game assessment frameworks on the game design and outcomes. Overall the research will assess the contribution of gaming in utilizing disaster diplomacy to foster cooperation within a basin with no prior cooperation mechanism. We have already developed the skeleton for the following publications and plan to complete them and submit to scientific journals for peer review:

1. ***Situation Awareness*** *is a fundamental element that is required for any policymaker to appreciate the value of joint action. There will be a paper published on the Effects of Nzoia WeShareIt on Situation Awareness. This paper assesses the results of the pre and post-game questionnaires on trust and trustworthiness.*
2. ***Team Interdependence*** *is a core element that is essential for joint action. There will be a paper published on the Effects of Nzoia WeShareIt on Team Task-Oriented Interdependence. This paper assesses the three-team interdependence game mechanics incorporated in the game and their contribution to Team Task-Oriented Interdependence.*
3. ***Trust*** *is also a core element that is essential for joint action. There will be a paper published on the Effects of Nzoia WeShareIt on Trust-building. This paper assesses the results of the pre and post-game questionnaires on trust and trustworthiness.*
4. *There will be a paper published on the Effects of Nzoia WeShareIt on* ***Cooperation****. This paper assesses the results of the post-game questionnaire and the inbuilt game data that incorporates the three cooperation game mechanics.*
5. ***Social Learning*** *is a crucial gaming outcome that is required for any policymaker to make informed decisions within and beyond the game. This paper assesses the contribution of the Nzoia WeShareIt game to social learning by assessing the inbuilt game data and the post-game questionnaire results.*
6. ***Discriminant Analysis:*** *We undertook a discriminant analysis of three factors: age, gender, and education. The paper assesses which of these factors had an impact on the game results and proposed a way forward in addressing inequality in water policy institutions and processes.*

4 The Appendices

4.1. The Appendices

This game design concept report consists of three appendices. The first appendix explains how we transitioned from BIOMAdneSS to WeShareIt. The second appendix focuses on the detailed changes that were made to be able to customize BIOMAdneSS to Nile WeShareIt and subsequently to Nzoia WeShareIt. The last appendix is a picture collage of the one Nile WeShareIt game session in Nairobi and the seven Nzoia WeShareIt game sessions, conducted in various county governments.

4.2. Appendix I: Transition from BIOMAdneSS to WeShareIt

The Delft University of Technology with the technical support of CE Delft customized the Nile WeShareIt from an existing Board game known as BIOMAdneSS (Fig. 14 (a)). Later, the Delft University of Technology, with the support of the TU Delft GameLab (http://seriousgaming.tudelft.nl/) customized the Nzoia WeShareIt (Fig. 14 (c) and (d)), from the existing Nile WeShareIt game (Fig. 14 (b)).

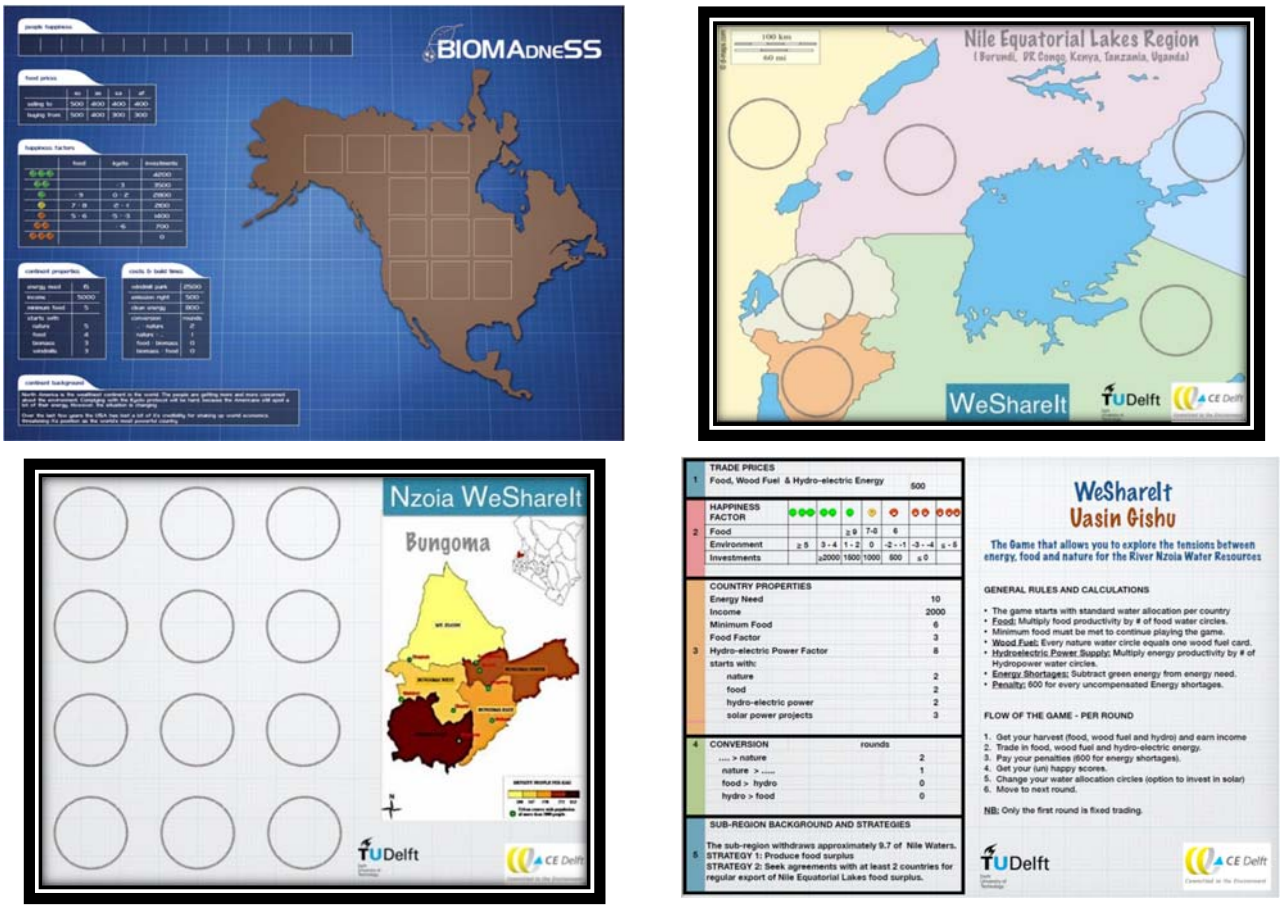

Fig. 14 (a) BIOMAdneSS Playing Field Board for North America continent (b) Nile WeShareIt Playing Field Board for the Nile Equatorial sub-region; (c) Nzoia WeShareIt Playing Field Board for the Bungoma County government; and (d) Nzoia WeShareIt Rules Card created separately from the Board for Uasin Gishu county government.

The initial redesign from BIOMAdneSS to Nile WeShareIt involved the actual game redesign and two main testing sessions with CE Delft. After the two testing sessions, the game skeleton was ready, but it needed further development to ensure it addresses the project and beneficiary needs. Therefore, the initial redesign was further refined and tested in the Delft University of Technology and Nairobi, Kenya, before finally being played in October 2015.

There are three main differences between BIOMAdneSS and WeShareIt. First, the subject matter, one emphasizes energy allocation and the other water allocation. Second, the level of governance. BIOMAdneSS is at the continental level, while WeShareIt is at an international and national basin level. Third, BIOMAdneSS is designed as a practice ring, to test plausible policy options, with similar multiple rounds. WeShareIt is also practice ring with an additional a surprise element of a drought round after the lapse of every three regular rounds. One unique feature of WeShareIt which is not present in BIOMAdneSS is the drought round, as discussed in the game elements section under the cycles and steps of play subsection, of this concept report.

BIOMAdneSS's primary focus is energy, and WeShareIt's primary focus is water. Both games are designed to help players realize that there is a struggle caused by increasing demand for food, energy, and nature. However, the struggle in BIOMAdneSS is for fertile land whereas the struggle in WeShareIt is for the scarce water resources. Therefore, BIOMAdneSS is mainly aimed at increasing cooperation to address energy challenges with scarce land/biomass resources. On the other hand, WeShareIt aims at increasing water cooperation to address water needs.

The levels of governance in BIOMAdneSS and WeShareIt are different. BIOMAdneSS focuses on the five continents, whereas WeShareIt is designed to address water issues at the basin level. The game redesign involved making critical decisions on which continent best represents a specific country or county government, within a particular basin. Table 7 is an illustration of the changes made to the playing fields.

Table 7: Changes in the Playing fields from BIOMAdneSS to the Nile and Nzoia WeShareIt

BIOMAdneSS continents	Africa	South America	Asia	North America	Europe
Nile WeShareIt countries	South Sudan	Ethiopia	Egypt	Sudan	Nile Equatorial Lakes
Nzoia WeShareIt counties	Kakamega	Trans Nzoia	Busia	Bungoma	Uasin Gishu

4.3. Appendix II: Changes Made from BIOMAdneSS to WeShareIt

The original parcels were land parcels, and they were square shaped. We converted the land parcels into circular water parcels. The playing field was initially for five continents (BIOMAdneSS), then converted to 5 Nile Basin countries (I sub-region) and finally to 5 county governments (Table 8).

Table 8: Changes made in Income, Food, and Energy Factor and Price of Solar in the Nile and Nzoia WeShareIt. The grey shading indicates the first instance changes. Green shading indicates changes in the second instance.

# circles or squares	11			7			20			12			6		
Playing Field[5]	Af	SS	KK	SA	Et	TN	As	Eg	Bu	NA	Su	Bu	EU	NEL	UG
Income	0	0	0	0	1000	1000	6500	6500	6500	5000	5000	5000	4000	2000	2000
Energy need	4	4	4	5	5	5	18	18	18	15	15	15	10	10	10
Minimum food	2	2	2	2	4	4	12	12	12	5	5	5	6	6	6
Food factor	1	4	2	1,5	2	4	1,5	1,5	1,5	2	1	1	3	3	3
Energy factor	1	1,5	1,5	1,5	8	1,5	1,5	1	1	1	1	1	1	1,5	8
Starts with:															
nature	7	7	7	3	3	3	7	7	7	5	5	5	2	2	2
food	4	4	4	3	3	3	10	10	10	4	4	4	2	2	2
hydro / biomass	0	0	0	1	1	1	3	3	3	3	3	3	2	2	2
windmill / solar	0	0	0	1	1	1	0	0	0	3	3	3	3	3	3
Initial energy trade prices	800	500	500	800	500	500	800	500	500	800	500	500	800	500	500
Penalty-energy shortages	600	600	600	600	600	600	600	600	600	600	600	600	600	600	600
Price windmill / solar	2500	2500	1500	2500	2500	1500	2500	2500	1500	2500	2500	1500	2500	2500	1500

The decision to replace a particular continent with a specific country or county government was made based on existing demographics, hydrological information, food and energy production capabilities, treatment of ecosystem services and water availability. There were changes made to existing food and energy productivity levels because the original game productivity levels did not fit precisely into WeShareIt. There were also changes made to the amount of income received and the price of solar cars. The object was not to represent the physical system, as is, but to mirror the social system to enhance learning and system restructuring.

[5] Africa (Af); South Sudan (SS); Kakamega (KK); South America (SA); Ethiopia (Et); Trans Nzoia (TN); Asia (As); Egypt (Eg); Busia (Bu); North America (NA); Sudan (Su); Bungoma (Bu); Europe (EU); Nile Equatorial Lakes (NEL); and Uasin Gishu (UG).

4.4. Appendix III: Pictures of Game Sessions

Central Government (22 October 2015)

Busia County Government (11 July 2016)

Busia County Government (12 July 2016)

Kakamega County (15th July 2016)

Bungoma County (18 July 2016)

Bungoma County (19 July 2016), Part 1

Bungoma County (19 July 2016), Part 2

Trans Nzoia County (21 July 2016), Part 1

Trans Nzoia County (21 July 2016), Part 2

Trans Nzoia County (22 July 2016), Part 1

Trans Nzoia County (22 July 2016), Part 2

Bibliography

1. Onencan, A., et al. *WeShareIt Game: Strategic Foresight for Climate-change Induced Disaster Risk Reduction*. in *Humanitarian Technology: Science, Systems and Global Impact 2016, HumTech2016*. 2016. Boston, USA: Procedia Engineering.
2. Mayer, I.S., *The gaming of policy and the politics of gaming: A review.* Simulation and Gaming, 2009. **40**(6): p. 825-862.
3. Enserink, B. and A. Onencan, *Nile Basin Scenario Construction.* 2017.
4. Onencan, A., et al. *Coupling Nile Basin 2050 Scenarios with the IPCC 2100 Projections for Climate-induced Risk Reduction*. in *Humanitarian Technology: Science, Systems and Global Impact 2016, HumTech2016*. 2016. Boston, USA.
5. Onencan, A.M. and B. Enserink *THE NILE BASIN BY 2050: Strategic Foresight on the Nile Basin Water Governance*. 2014. 28.
6. Nile Basin Initiative (NBI), *Press statement issued by Hon. Mutaz Musa Abdalla Salim Chairperson of the Nile Council of Ministers and Minister of Water Resources and Electricity of The Sudan At the close of the 4th Nile Basin Development Forum*, in *Building Sustainable Trans-boundary Cooperation in a Complex River Basin: Challenges, Lessons and Prospects (Theme)*, N.B. Initiative, Editor. 2014: Nairobi, Kenya. p. 4.
7. Onencan, A.M., *WeShareIt Video for the Ministry of Water and Irrigation Game Session*. 2015: Nairobi, Kenya.
8. Nile Basin Initiative (NBI), *State of the River Nile Basin Report*. 2012, Nile Basin Initiative: Entebbe, Uganda.
9. Onencan, A., et al., *MAFURIKO: Design of Nzoia Basin Location Based Flood Game.* Procedia Engineering, 2016. **159**: p. 133-140.
10. Onencan, A.M., *TU Delft serious game elevates Nzoia*. 2017.
11. Onencan, A., et al., *Weshareit: A Nexus Approach To Nile Basin Water Resources Management.* Decision making under deep uncertainty, 2015.
12. Peters, V. and M. van de Westelaken, *Simulation Games - A Concise Introduction to the Design Process*. 2014, Samen spraak spel simulaties: Nijmegen, The Netherlands.
13. Duke, R.D., J.L.A. Geurts, and A. The, *Designing the policy exercise*. 2004. 269-305.
14. Onencan, A., *TU Delft serious game elevates Nzoia.* 2017.
15. Mandryk, R.L. and D.S. Maranan. *False prophets: exploring hybrid board/video games*. in *CHI'02 extended abstracts on Human factors in computing systems*. 2002. ACM.
16. Rocha, J.B., S. Mascarenhas, and R. Prada, *Game mechanics for cooperative games.* ZON Digital Games 2008, 2008: p. 72-80.
17. Zagal, J.P., J. Rick, and I. Hsi, *Collaborative games: Lessons learned from board games.* Simulation & Gaming, 2006. **37**(1): p. 24-40.
18. Depping, A.E. and R.L. Mandryk, *Cooperation and Interdependence: How Multiplayer Games Increase Social Closeness.* 2017.
19. Bergström, K., S. Björk, and S. Lundgren. *Exploring aesthetical gameplay design patterns: camaraderie in four games*. in *Proceedings of the 14th International Academic MindTrek Conference: Envisioning Future Media Environments*. 2010. ACM.
20. Bozanta, A., et al., *Multi user virtual environments and serious games for team building.* Procedia Computer Science, 2012. **15**: p. 301-302.

21. Nasir, M., et al. *The effect of a collaborative game on group work.* in *Proceedings of the 25th Annual International Conference on Computer Science and Software Engineering*. 2015. IBM Corp.
22. Beznosyk, A., et al. *The effect of closely-coupled interaction on player experience in casual games*. in *International Conference on Entertainment Computing*. 2012. Springer.